

Remarks

The foregoing proposed amendment presents amended claims 1, 12, and 14. The remaining claims 2-11, 13, and 15-20 are the original claims. As a result of this Amendment, claims 1-20 remain in the application. Allowance of claims 1-20 is respectfully requested.

Claims 1, 14, and 18 are objected to because the examiner believes the "output voltage is somehow constrained by input voltage." This is a point of novelty with respect to most embodiments of the present invention. The Applicant claims that the "output voltage is unconstrained by an input voltage from the input voltage source" because embodiments of the invention are embodied by a four-quadrant output from a single switching converter that has no theoretical limit on its output voltage. This is in contrast to the cited art as will be further discussed below. Furthermore, as explained with regard to equation number 5 in the Applicant's specification: (5) $V_{out} = V_{in} \times [(T_{s2} - T_{s1})/T_{s3}] \dots$ "...as the absolute value of the time ratio in the brackets of equation (5) approaches infinity, the absolute value of the output voltage V_{out} also approaches infinity for any nonzero value of V_{in} , thus, the output voltage is not limited by the input voltage V_{in} ."

Next, the examiner objected to claim 11 since the Examiner states that "A power converter can't perform as an amplifier." As explained in paragraph [0025] of the Applicant's specification, if the Output-voltage Control Signal input to the Pulse Modulator is AC, the output voltage will also be AC and the converter will function as an amplifier. Thus, the power converter can perform as an amplifier. The Examiner's objection may stem from conventional thinking regarding power converters, as their most common application is as DC power sources having fixed, unchanging control input to the Pulse Modulator and a fixed DC output. Yet most converters are capable of variable output. The claimed invention certainly can function as an electrical amplifier as they are commonly understood, that is, a device whose output voltage, current, or power is larger than the voltage, current, or power of an input signal and substantially proportional to the input signal. While not expressly stated in the Application, the claimed invention can also amplify DC signals as well as AC.

The Examiner rejected claims 1-20 under 35 U.S.C. Section 102(b) as being anticipated by U.S. Patent No. 6,429,629 to Tranh To Nguyen ("Nguyen"). As stated in the background of Applicant's specification, Nguyen discusses converters that have a center-tapped wound

magnetic element or transformer with a DC input applied to the center tap and switches from each winding end to ground. The converters in Nguyen only operate in one voltage-current quadrant (positive voltage, positive current or negative voltage, negative current) as opposed to all four quadrants as recited in the claimed invention in independent claims 1, 14, and 18. The output voltage magnitude in Nguyen is also constrained by the input voltage. Nguyen states that the converters shown in FIGs. 3A-3J are capable of output of "any polarity and magnitude." However, it must be understood that all of the converters in Nguyen operate inherently in one quadrant depending on the direction of the diodes or synchronous rectifiers and that the output magnitude is constrained by the input voltage and turns ratio of the transformer as stated on column 3, lines 47 through 52 of Nguyen. Thus, since the claims specifically recite operation in all four voltage current quadrants and further recite an output voltage unconstrained by the input voltage, the present invention is novel and certainly not obvious in view of the cited art. Further, it would also seem to be improper use of hindsight to attempt to use Nguyen as a reference to try to obviate the recited claims, particularly in view of the novel and nonobvious differences discussed above and in Applicant's background section. Again, the claimed invention overcomes the limitation of a constrained output voltage.

With respect to some of the dependent claims, particularly claims 7-10, it also appears that Nguyen fails to teach or even suggest, mention or contemplate a pulse modulator that controls the plurality of switches such that the third switch is on when neither the first switch nor second switch is on and such that the first switch and the second switch cannot be on at the same time as recited in claim 7. Nor does Nguyen appear to teach a plurality of switches that operate in a cyclical sequence and at a constant frequency as recited in claim 8, nor an on-time of the third switch that is constant and less than a period of the cyclical sequence as recited in claim 9. Finally, with respect to claim 10, Nguyen also fails to teach a power converter where the closure of the first switch causes current flow into a reference phase inductor terminal to increase while the second switch causes current flow into a second reference phase inductor terminal to decrease such that a greater on-time among the first switch and the second switch determines the polarity of the output voltage.

The Examiner may have misconstrued Nguyen's vague language to mean that Nguyen is capable of four-quadrant output when it is not. Nguyen does not talk about an output current independent of output voltage. His use of a first and a second "unidirectional conducting device"

(such as a diode) or a first and a second "unidirectional switchable semiconductor device" (such as a transistor) in all figures, including 3A-3J cited by the examiner clearly forces output current to be of the same polarity as the output voltage because the output current can flow in only one direction. Thus operation is restricted to a single quadrant. Thus, for all the reasons provided above, Applicant respectfully submits that claims 1-20 are novel and non-obvious and overcome the rejection based Nguyen under 35 U.S.C. Section 102(b).

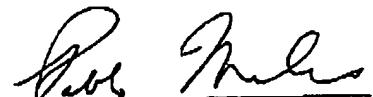
The Examiner also rejected claims 1, 14, and 18 under 35 U.S.C. Section 102(b) as being anticipated by U.S. Patent No. 6,166,513 to Hammond ("Hammond"). Although Hammond discloses an input voltage source 76, an output voltage 106, and a switching arrangement, Q1, Q2, Q3, and Q4, Hammond fails to teach or even begin to suggest, mention or contemplate a power converter having an output current independent of an output voltage where the output voltage is unconstrained by an input voltage from the input voltage source as recited in claims 1 and 14. Likewise, claim 18 recites a method where an output current is independent of an output voltage and the output voltage is unconstrained by an input voltage. Hammond specifically states on column 4, lines 56-57 that "each power cell 70 may have only three possible output voltages at any instant in time." This is a constrained output voltage. The output voltage in the claimed invention is unconstrained. Applicant also respectfully submits that claims 1, 14, and 18 are novel and non-obvious and overcome the rejection based Hammond under 35 U.S.C. Section 102(b).

During what Hammond describes as "motoring", the output voltage is constrained by the input voltage in this way: the absolute value of the output voltage is less than or equal to the peak phase-to-phase voltage of the three-phase source 108 of Fig. 4, which is also essentially the rectified DC voltage that appears across the two series-connected capacitors 76a and 76b of the same figure. We suspect that this might be equivalent to the "input voltage" to some of the embodiments of the present invention. In Hammond's example described in column 4 lines 56 – 65, only three possible output voltages of +600, -600 and zero are cited, an output constrained by the input.

Hammond also fails to suggest, mention or contemplate an output terminal in common with an input terminal. If "an input terminal" means in the context of Hammond's invention a secondary terminal of transformer 108 in Fig. 4, none of these terminals can be connected to either output terminal 78 or output terminal 80 of the same figure.

An indication of allowability is respectfully requested. Should any minor points remain prior to issuance of a Notice of Allowance, the Examiner is requested to telephone the undersigned at the below listed telephone number.

Respectfully submitted,



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